

THE FERN GENUS DIPLAZIUM IN THE MALAY PENINSULA

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General

The ferns of the genus *Diplazium* occurring in the Malay Peninsula are all, with the exception of *D. esculentum* and *D. polypodioides*, found on the ground in shady forest, many of them only in moist places near streams. They are especially characteristic of the valleys at medium elevations in the mountains, though a few species are common in the more open parts of the forest. There are no epiphytes and no climbing species among them. Nearly all have short erect rootstocks (sometimes developing a short trunk) and tufted fronds, sterile and fertile fronds being almost alike.

There is comparatively little difference of external form among the species of the same degree of division (*i.e.*, among pinnate and among bipinnate species), and there is of course a certain amount of variation according to age and influences of habitat, so that the clear distinction of species is at first sight difficult, and there has in fact been much confusion in the past. I have found, however, that the characters of the scales are most useful in distinguishing species of similar habit, and I believe that I have arrived at a clear distinction of our local species, with the possible exception of *D. Prescottianum*.

I have been unable to identify four of our species with any described from places outside the Peninsula, and so have described them as new. There are undoubtedly a very large number of species within the Malayan region, but I think that a good many have been described more than once. The descriptions are, however, inadequate as a basis for comparison, and much herbarium material is incomplete (part only of a leaf, or lacking in scales, or representing an immature stage). A study of much material over a wide area is necessary before a proper account of the genus in the Malayan region can be given.

Diplazium cordifolium provides a remarkable case of polymorphism leading to confusion of names. Young plants develop rather large simple fronds which are often fertile, and this stage may persist indefinitely, especially in the lowlands. Mature plants, however, often bear pinnate fronds with several pairs of pinnæ. The two stages have been separately named; and the fact that other superficially similar simply pinnate species have sometimes a few veins anastomosing has also led to confusion between these and the mature form of *D. cordifolium*. The young

stages of species may be characteristic, and so useful diagnostically, in this genus as in other fern genera, but they have been little studied. I have noted especially the early stages of *D. bantamense* and *D. riparium*.

In the following account of the species found in the Malay Peninsula, I have not attempted to give full lists of synonyms. There has been so much confusion in the application of names that such lists of synonyms would be difficult to compile accurately. I believe that the names used are all correctly applicable to our species; but I differ in some cases from the usage of the recent book by Backer and Posthumus on the ferns of Java. In such cases, the synonymy is briefly discussed.

As regards citation of specimens, this is done only where I believe there has been confusion in the past, or in the case of new species; in cases of well characterized species such as *D. accedens* and *D. cordifolium* there seems no need for the publication of lists of specimens. Specimens collected in our Singapore Field Number series (started by Burkill in 1912) are cited as S.F.N. Duplicates of many of these will be found in other herbaria, in some cases under other names than those now given. A list of numbers at the end of this paper may therefore prove helpful. It should be noted that the earlier distribution labels did not bear the words "Singapore Field Number".

A fairly full description is given for each species. To aid in the identification of specimens, the most distinctive characters in each description are italicised.

Distribution

Until a full investigation is made, it is impossible to give a complete picture of the distribution of the species of *Diplazium* found in the Malay Peninsula. There are certainly cases in which one name is used in different countries to cover different species, and conversely the same species sometimes goes by different names in different countries. From the material at my disposal in the Singapore herbarium, it is, however, possible to make a few generalizations.

A few Malayan species certainly have a wide distribution, notably the two that grow in open places, *D. polypodioides* and *D. esculentum*. These both appear to extend from N. India and S. China right through the Malayan region to N. Guinea or beyond. *D. polypodioides* has various synonyms, and it appears that specimens from India and China need checking against the Java type.

D. accedens may have an even wider distribution if it should be found indistinguishable from *D. proliferum*, of which the type comes from the Mascarene Islands. A

similar case is that of *D. silvaticum* (type from Mauritius), but this is a less well characterized species, and its true Asiatic distribution is in doubt.

D. sorzogonense is another interesting case of a widely distributed species. This has undoubtedly been confused with *D. speciosum* and probably also with other species, but I have seen quite typical specimens from the Philippines and New Guinea. It is perhaps significant that this species is found in lowlands and mountains alike in Malaya, and is not confined to the most moist and shady places. *D. speciosum*, on the other hand, is certainly more restricted in distribution, and in Malaya is only found in the mountains, the typical form only (hitherto) on G. Tahan on the east side of the Peninsula.

D. montanum is a case of more restricted distribution. Our ferns which I now so name were formerly called *D. pallidum*. The latter species, however, as found on the mountains of Java and Sumatra, is clearly distinct, and I find that our ferns agree with the type of *D. montanum* from Sumatra. *D. montanum* appears to occur at lower altitudes in east and south Sumatra; i.e., those parts adjacent to Malaya.

D. heterophlebium is our only case in this genus of a species finding the southern limit of its distribution in Malaya.

So far as our present knowledge goes, the following species appear to be confined to the Malay Peninsula: *D. insigne*, *D. subintegrum*, *D. velutinum*, *D. procumbens*, *D. Kunstleri*, *D. simplicivenium*. All these are ferns of the moist, shady mountain valleys.

D. insigne is a remarkable fern of the alliance of *D. accedens* but very large. *D. subintegrum* is allied to *D. pallidum* but in my opinion quite distinct. *D. velutinum* is probably the most local of all, a derivative of *D. tomentosum*. *D. procumbens*, *D. Kunstleri* and *D. simplicivenium* are distinct members of the very large bipinnate group, the Peninsular species of which have been mostly hitherto lumped under the names *D. dilatatum* or *D. latifolium*.

Characters of the Genus

There has been much discussion on the status of the genus *Diplazium* and on its relationship to *Athyrium*. I do not feel that I can offer any new evidence, more especially as the typical species of *Athyrium* (in the stricter sense) occur outside Malaya. In view of Christensen's remarks in this Bulletin, Vol. 7, p. 268, and in view of the fact that in Malaya *Diplazium* and *Athyrium* are quite distinct, I here maintain the genus *Diplazium*, as in Christensen's *Index Filicum*.

The principal characters of the genus may be summarized as follows:—

Stock usually short, erect, sometimes forming a short trunk, in a few cases creeping, but (in Malayan species) the fronds always tufted; roots rather coarse, black, sometimes forming a very close mat on the surface of the ground. Scales on young fronds orbicular to linear, edges entire or toothed, the cells usually elongated, walls of rather uniform thickness, colour throughout medium to dark brown (never clathrate), the teeth where present always formed of two adjacent cells, the ends of which may separate; edges of scales also provided sometimes with short glandular hairs. Stipes relatively stout, sometimes bearing papillae or spines near the base or throughout, these prominences being the bases of fallen scales. Rachises glabrescent, minutely scaly or in a few species hairy on the rounded lower side, papillate in the grooved upper side. Midribs of pinnae and pinnules grooved above, the edges of the groove often strongly winged, the wing often interrupted and/or extended at the junction of the midrib of a pinnule or the main vein of a lobe. Lamina simple, pinnate or bipinnate, texture mostly thin, pinnae and pinnules of bipinnate fronds with subequal base, the venation never anadromous. Veins in most species free, in a few species adjacent vein-groups anastomosing more or less freely. Sori elongated along the veins, with lateral indusium; the lowest acroscopic sorus in any group usually double (diplazoid), and occasionally other sori double also; double sori usually with two quite separate indusia, never grading into a horse-shoe shape with indusium continuous all round.

As compared with the above description, most species of *Athyrium* have an anadromous venation and division,

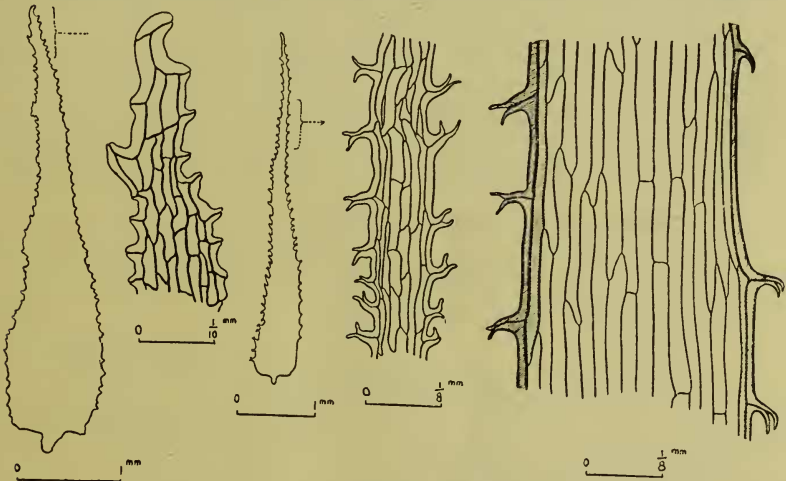


Fig. 1. Scales from base of stipe. On left, *D. crenatoserratum*, outline of single scale and apex enlarged. Centre, *D. silvaticum*, same, showing forked teeth. On right, *D. accedens*, middle part of scale; shaded cells at edges are black.

the pinnules often with very unequal bases, the scales are always relatively broad and entire, usually rather pale and thin, and the sori are always short and broad, the diplazioid ones often of a horse-shoe shape, the two sides of the sorus being connected.

In the character of grooved upper surface of costæ and costules and the winged margins of the groove, both *Diplazium* and *Athyrium* agree with *Eu-Dryopteris* and *Polystichum* rather than with *Thelypteris*; and the teeth on the scales on certain species of *Diplazium* are similar in structure to the teeth of *Dryopteris* and *Polystichum*. No scales in *Athyrium* or *Diplazium* (so far as I have observed) have hairs on the margin as found in many species of *Thelypteris* and *Cyclosorus*.

The markedly anadromous leaf-architecture found in many species of *Athyrium* is matched in the group of species formerly called *Polystichum* but now separated by Ching as *Rumohra*. Such leaf-architecture does not occur in *Thelypteris*.

It appears therefore that *Athyrium* and *Diplazium* are more nearly related to *Eu-Dryopteris* than to *Thelypteris*.

Though the leaf-architecture in many species of *Athyrium* is anadromous, there are clearly catadromous species (*e.g.* *A. silvaticum*) commonly referred to that genus. It seems possible that the type of leaf-architecture may afford a useful character in subdividing the genus.

The true *Athyriums* in the Malayan region are all species of rather high mountains (which is probably the reason why they are little represented in Malaya, which has much less high land than the great Sunda Islands), whereas species of *Diplazium*, as noted above, are characteristic of lowlands and medium elevations in the mountains.

Key to the Species of *Diplazium* of Malaya

N.B.—This Key applies only to full-grown plants.

Fronds simple.

Fronds to 4 cm. wide, narrow at

base *D. subserratum*

Fronds more than 4 cm. wide,

broadly cordate at base *D. cordifolium*

Fronds simply pinnate.

Scales entire, not toothed

Veins anastomosing copiously

veins anastomosing near costa *D. heterophlebium*

veins anastomosing only in

marginal third of lamina *D. cordifolium*

- Veins free or only slightly anastomosing
 fronds to about 15 cm. wide,
 costæ hairy beneath .. *D. tomentosum*
 fronds usually wider, costæ not
 hairy beneath
 pinnæ cut half way or
 more to costa
 sori impressed, rachis
 fibrillose, veinlets to
 10 pairs .. *D. sorzogonense*
 sori not impressed,
 rachis not fibrillose,
 veinlets to 7 pairs .. *D. malaccense*
 pinnæ cut less than half
 way to costa
 pinnæ to 5 cm. or
 more wide
 veins at 45° to
 costa, pinnæ to 12
 pairs .. *D. xiphophyllum*
 veins at more than
 60° to costa, pin-
 næ to 5 pairs .. *D. riparium*
 pinnæ under 5 cm.
 wide
 lower veinlet of
 group simple or
 once forked .. *D. montanum*
 lower veinlet more
 copiously branch-
 ed
 2 veins of each
 group sori-
 ferous .. *D. subintegrum*
 4-6 veins of
 each group
 soriferous .. *D. Prescottianum*
- Scales toothed
 Veins much anastomosing .. *D. accedens*
 Veins free or only occasionally
 joining near margin
 pinnæ subentire, more than
 2 cm. wide .. *D. bantamense*
 pinnæ lobed, or if entire, less
 than 2 cm. wide
 pinnæ lobed $\frac{3}{4}$ or more
 towards costa .. *D. speciosum*

pinnæ lobed less than $\frac{3}{4}$
towards costa

pinnæ thin in texture,
not auriculate below, scales
strongly toothed

D. silvaticum

pinnæ thicker in texture,
often auriculate below,
scales irregularly and shortly
toothed ..

D. crenatoserratum

Fronds bipinnate.

Veins anastomosing

stipes smooth, pinnules usually
less than 2 cm. wide, lobed
about $\frac{1}{4}$ to costa ..

D. esculentum

stipes spiny, pinnules always
more than 2 cm. wide, toothed
only

D. insigne

Veins free

scales $\pm$ round, peltate, entire

sori very short, basal on veins

D. latisquamatum

sori longer, medial on veins ..

D. Kunstleri

scales much longer than broad

frond to about 30 cm. long ..

D. velutinum

frond much longer

lobes of pinnules 3-4 mm.

wide, cut more than $\frac{3}{4}$ to

midrib

D. polypodioides

lobes of pinnules 7 mm. or

more wide, cut less than $\frac{3}{4}$

to midrib

rhizome procumbent,

fronds to 80 cm. long

D. procumbens

rhizome erect, fronds to

more than 100 cm.

long

lower pinnules

sessile, to c. 2 cm.

wide, veins to 5

pairs, all simple

D. simplicivenium

lower pinnules on

stalks to 5 mm.

long, to more

than 2 cm. wide,

veins 5-8 pairs,

some forking ..

D. dilatatum

1. *Diplazium accedens* Bl. Enum. 192. 1828.

Stock stout erect, sometimes a short trunk. *Stipes* stout, green, covered with soft green protuberances near base, to c. 60 cm. long; when young covered with narrow scales, each on the end of a protuberance, the scales to 1.5 mm. wide at base, dull brown, thick in texture, with narrow black toothed edge (see fig. 1). *Lamina* simply pinnate, to 120 cm. or more long and 50 cm. wide, pinnæ about 15-jugate; apex of frond like the lateral pinnæ or with 1 or 2 deep lobes at the base; rachises and costæ glabrescent, smooth, buds common in the axils of the pinnæ. Lower pinnæ on stalks to 8 mm. long, upper sessile, gradually smaller. *Largest pinnæ* to 40×8 cm., base truncate or very broadly cuneate, sides parallel for $2/3$ or more of the length of the pinnæ, then tapering to acute apex, edges entire or very shallowly lobed, the lobes slightly toothed. Main lateral veins in the pinnæ about 8–12 mm. apart on the costa, at about 60° to the costa, each bearing up to 10 pairs of lateral veinlets, the lateral veinlets of adjacent groups anastomosing when they meet and so producing a series of parallelogram-shaped areolæ; anastomosis of small veins near edge of lamina irregular. Sori on some or all the veinlets, often throughout their length.

A fern of shady mountain stream-sides found in Malaya only on the Main Range and Taiping Hills. Sometimes in very large fronds there are extra areoles between the normal groups adjacent to the main lateral veins; a specimen having this character formed the basis of *Athyrium Ridleyi* Copeland, which I include in the present species.

This species is closely related to *D. proliferum* (Lam.) Thouars, and the two should perhaps be united; if so, the species in this broader sense would extend from the Mascarene Islands to the Pacific. A study based on material from all parts of this wide range is required to decide on the status of *D. accedens* and *D. proliferum*.

As regards the name *D. accedens*, the situation is a little complicated. It appears that the three names *D. accedens*, *D. repandum* and *D. Swartzii*, all published in the same book by Blume, are to be regarded as synonymous. Later authors have in many cases regarded all as synonyms of Lamarck's earlier name, or of *Asplenium decussatum* Sw.; the names *Swartzii* and *accedens* have been taken up and used in the genera *Callipteris*, *Asplenium* and *Athyrium*, but the name *D. repandum* appears to have been almost or entirely ignored. Backer and Posthumus (1939), however, have revived the name *D. repandum*, apparently on grounds of page priority (though they do not state this) which is not admitted by the Rules. In their synonymy, however,

they include *Diplazium proliferum* Thouars, an older name; their use of the name *D. repandum* is therefore contrary to the rules.

It appears to me that, if the Malaysian fern is to be regarded as specifically distinct from that of the Mascarene Islands, the name *Diplazium accedens* Bl. is the appropriate one to use, as this name has already been used by Christensen in the 3rd Supplement to his *Index Filicum* (1934), and had previously been used in a varietal sense for Java ferns by van Alderwerelt van Rosenburgh.

2. *Diplazium bantamense* Bl. Enum. 191. 1828.

Stock short suberect. Stipes to 60 cm. long, glabrescent, clothed at the base with *brown scales about 1 cm. long and 1.5 mm. wide at base, edges finely toothed. Frond simply pinnate*, to about 60 cm. long and 25 cm. wide, *pinnæ up to about 8 pairs*, terminal pinnæ similar to the others or occasionally with a large lobe at the base; *a bud often present on the rachis at the base of one of the upper pinnæ*. Basal pinnæ on stalks 3 mm. long, base slightly unequal, on the lower side rounded and on the upper side cuneate at 45° and decurrent; bases of the upper pinnæ more equally rounded. *Sub-basal pinnæ largest*, up to about 20 by 7 cm., *commonly about 12 by 4.5 cm.*, widest a little above the base, then narrowed gradually to the acuminate apex; *edges entire or toothed only near the apex*, texture firm; veins usually distinct on both surfaces but sometimes obscure, at rather more than 45° to the costa, forked at or near the costa, the upper branch simple and often soriferous almost throughout its length (diplazioid sorus), the lower branch forked again 1-3 times, 1-3 of the branches often bearing short simple sori towards the margin; occasionally a slight anastomosis of veins towards the margin; indusia narrow, persistent.

Young plants have fronds with simple lamina to about 15 by 5 cm., deeply cordate or almost sagittate at the base, later fronds having one or more pairs of lateral pinnæ below the terminal lamina. This behaviour is closely similar to that of *D. cordifolium*; but *D. cordifolium* develops a much larger simple lamina, which usually becomes fertile, before producing fronds with free lateral pinnæ.

The name *D. bantamense* has in the past been given to all Peninsular specimens of *Diplazium* with free veins and rather broad subentire pinnæ. These I now separate into *D. bantamense* with toothed scales, *D. xiphophyllum* and *D. riparium* with entire scales. I find that *D. bantamense* as above described agrees well with Java specimens, and hence, though I have not seen the type, I feel confident that I have selected the correct Peninsula

fern to bear this name. It is a fern of moist shady forest, chiefly in the hills, sometimes near streams in lowland forest. In the shape of its pinnæ, it most nearly resembles the pinnate form of *D. cordifolium*, but the much anastomosing veins of the latter distinguish it.

Specimens in Singapore Herbarium:—

TRENGGANU. Kuala Berang, on streambank, Holttum s.n., 14.5.1925.

PAHANG. Fraser's Hill, 4,000 ft., S.F.N. 10018 (Holttum & Burkill); S.F.N. 11473 (Holttum); S.F.N. 36505 (Holttum). Cameron Highlands, Robinson Falls, 4500 ft., S.F.N. 17978 (Henderson); 4,800 ft., S.F.N. 23340 (Holttum). Sungei Teku, 500 ft., S.F.N. 20554 (Holttum).

PERAK. Waterloo, Curtis 1361 p.p. (narrow toothed pinnæ, and apical pinna lobed; a doubtful specimen). Ulu Temango, Ridley 14229. Taiping, 300–500 ft., King's Collector 8388. Upper Perak, 300 ft., Wray 3616.

NEGRI SEMBILAN. Ulu Bendul, S.F.N. 9876 (Holttum).

SELANGOR, near the Gap, 2,700 ft., S.F.N. 37159 (Addison).

PENANG, near Tiger Hill, 2,500 ft., S.F.N. 19346 (Holttum).

3. *D. cordifolium* Bl. Enum. 190. 1828.

Stock short erect. Stipes to 50 cm. or more long, clothed at the base with brown scales about 1.0 cm. long and 1.5 mm. wide at base, *edges of scales entire*. *Fronds of two kinds, either simple with cordate base, or pinnate with ovate entire pinnæ*; transition forms also occur, but fully-grown plants may bear simple fronds. *Lamina of simple fronds to 35 cm. long and 12 cm. wide, the base cordate* (often with a bud on the costa close to the base) the apex more or less acuminate, the margin entire; texture thin but firm, veins clearly visible on both surfaces; veins at more than 60° to the midrib, forked close to the midrib, the lower branch forked again, lateral members of the groups so formed anastomosing about half-way towards the margin, *the outer part of the lamina containing a series of narrow areoles about 1 mm. wide and 1 cm. or more long*. Sori on the outer veins of each group and also on some of the inner veins, anastomosing with the veins, and reaching almost to the edge of the lamina; indusia narrow, persistent. *Pinnate fronds with 1–8 pairs of pinnæ* below the terminal lamina, which is smaller as the number of lateral pinnæ increases. Lateral pinnæ sessile or the lowest very shortly stalked, varying much in size, the basal pinnæ largest, upper ones

gradually smaller; base of pinnæ subequally rounded, *margins quite entire*, apex shortly acuminate; largest pinnæ usually 12–16 cm. long and from 2.5 to 6.5 cm. wide; *veins as in the simple lamina above-described*, but more oblique to the midrib of the pinnæ (at about 45°).

This species is frequent in both lowland and mountain forest in Malaya but is never found in the open. In the lowlands it rarely (if ever) develops beyond the stage of simple fronds, and in the mountains it appears that some plants remain for a considerable time at this stage, which is usually fully fertile. It is common, however, in mountain forest to find plants which have one or more pairs of lateral pinnæ below the cordate terminal lamina, and all stages of transition can be found up to fronds with 7 or 8 pairs of lateral pinnæ. Specimens of the latter have usually been named *D. fraxinifolium* Pr. or *D. lineolatum* Bl., simple fronds being called *D. cordifolium*.

Backer and Posthumus (*Varenflora voor Java*, p. 123), recognizing that both simple and pinnate forms belong to one species, use the name *D. fraxinifolium* Presl. Presl's name was published prior to *D. cordifolium*, but the description is very inadequate (anastomosis of veins is not even mentioned) and I think it better to use Blume's name, which is well established. Owing to the polymorphism of this species, and to the superficial resemblance of pinnate forms to *D. bantamense* Bl., there has been much confusion of names.

The parallel between *D. bantamense* and *D. cordifolium* is a close one. Both ferns have at first simple fronds, and later one or more pairs of lateral pinnæ which are broad and sub-entire. There are, however, several clear differences. The scales are toothed in *D. bantamense* and entire in *D. cordifolium*; the veins are almost always quite free in *D. bantamense* but copiously anastomosing in *D. cordifolium*; and the initial stage of simple lamina is much more developed in *D. cordifolium*, being often fertile, whereas the simple lamina of *D. bantamense* is only found in young plants and is rarely fertile.

I think it unnecessary to cite the many specimens of this species which have been obtained in all parts of Malaya.

4. *D. crenatoserratum* (Bl.) Moore, Index 121. 1859.
Asplenium Bl. Enum. 177. 1828.

Stock short, erect. Scales on young fronds and bases of stipes to about 4 by 1.5 mm., acuminate, edges irregularly and shortly toothed, teeth not forked (see fig. 1). Stipes to about 30 cm. long. Fronds simply pinnate, commonly about 30 cm. by 15 cm., sometimes larger, pinnæ numerous, close, the upper adnate, grading into the lobed deltoid apical

lamina, the lower longest, on stalks to 5 mm. long, commonly about 15 by 2 cm., sometimes larger, texture firm. *Pinnæ of fronds on young plants with bluntly rounded apex, edges almost entire, base truncate and slightly auricled above. Pinnæ on large plants acuminate, edges lobed $\frac{1}{4}$ – $\frac{1}{2}$ way towards costa, base strongly auricled above and less so below; lobes close, usually irregular in length; veins pinnate in the lobes, to about 4 pairs, often all fertile, the sori from the costa almost to the edges, the sorus on the lowest acroscopic vein diplazioid, the others not.*

This is a very common fern of lowland forest, varying much in size and in the degree of lobing of its pinnæ. Young (or small) plants with blunt entire pinnæ may be fertile. The largest plants approach *D. silvaticum*, but differ in the points mentioned under that species. It approaches also *D. tomentosum*, some specimens having many short hairs, like those of *D. tomentosum*, on the base of pinna-stalks beneath, and to much less extent on the main rachis; but *D. crenatoserratum* is never so tomentose as typical *D. tomentosum*. Typical specimens of the two species are very different, but some are almost intermediate; distinguishing characters are given under *D. tomentosum*.

5. *Diplazium dilatatum* Bl. Enum. 194. 1828.

A very large fern, with stout erect stock. Stipes 8 mm. or more in thickness near base, slightly rough with raised bases of fallen scales; scales to about 1.5 cm. long, hardly 1 mm. wide at base, brown with black toothed edges. Lamina bipinnate-tripinnatifid, pinnæ to 75 cm. long and 27 cm. wide, pinnules to about 12–jugate below deltoid lobed apex of pinna. Rachis glabrescent, costæ with scattered very narrow brown scales, especially near base and on stalks of pinnules. Largest pinnules to 18 by 4 cm. (commonly narrower) on stalks 5 mm. long, base truncate-subcordate, apex acuminate, cut half-way to costa or a little more, segments 8–10 mm. wide at base, slightly oblique, edges slightly toothed, apex rounded; smaller distal pinnules sessile, lobed less deeply; texture thin but firm, colour when dry dark. Veins in each lobe pinnate with 5–8 pairs of veinlets, lowest acroscopic veinlet often simple, the rest usually forked (sometimes simple in fronds of small or young plants), sori from near base along $\frac{1}{2}$ – $\frac{2}{3}$ length of the veinlets; sorus on basal acroscopic veinlet usually diplozioid, rest not.

This very fine species has only been found in Malaya at Cameron Highlands. The Highlands specimens closely match a fern from Java (G. Ardjœnœ, 1800 m. Posthumus 3939) and also the Sumatran specimens quoted below. I

think they are quite distinct from the more numerous specimens, mostly from lower elevations, referred in this paper to *D. simplicivenium*.

Specimens in Singapore Herbarium:

PAHANG. Cameron Highlands, 4,600 ft., S.F.N. 23620 (Henderson); S. Terla, 3,900 ft., S.F.N. 31334 (Holttum), young plant.

SIAM. Doi Chiang Dao, Eryl Smith 1198.

SUMATRA. Brastagi, 5,000 ft. S.F.N. 15403 (Holttum). Dolok Singgalang, N. v. h. Tobameer 1650 m., Lorzing 8864.

Copeland Pterid. Philip. Exsicc. 178 (Mt. Matutum, April 1917) seems to me closely similar to the above specimens and I would refer it to the same species.

6. *Diplazium esculentum* (Retz.) Sw. Schrad. Journ. 1801, 2: 312. 1803. *Hemionitis esculenta* Retz. Obs. Bot. 38. 1791.

Stock erect. Stipes to 50 cm. or more long, glabrescent except for a few brown scales at base; scales about 1 cm. long and 1 mm. wide, the edges finely toothed. *Lamina bipinnate*, large, often 1 m. or more long and about half as wide. Pinnæ to 50 cm. or more long, bearing numerous pinnules which are often rather distant from each other. *Pinnules varying much in size and cutting, usually less than 2 cm. wide*, the lowest stalked 2 mm., the rest sessile, *truncate or broadly cuneate and usually more or less auricled on one or both sides at the base, edges crenate or lobed up to about 1/4 distance to costa*, the lobes or crenations slightly toothed. Veins in pinnate groups in the lobes, about 8–10 pairs of side veins, *the lower 2–3 pairs of adjacent groups anastomosing*, forming an irregular intermediate excurrent vein leading towards a sinus between adjacent lobes. Texture thin; rachises and costæ glabrescent, or occasionally pubescent beneath with numerous pale brown hairs with dark cross-walls, and scattered or abundant small ovate toothed scales on costæ. Sori occupying almost the whole length of the veins, often also on part of the joint excurrent vein, often more than one diplazioid sorus in each group.

This is a common fern of wet ground in open places in the lowlands of Malaya, and is well known as an edible plant. It never occurs in shady forest. It is a straggling and untidy species, lacking the beauty of most of the larger species of this genus.

The excurrent vein formed by union of the lateral veins of adjacent groups does not run to the sinus, stopping there in a thickened single unit, as in *Cyclosorus* (*Dryopteris* p.p.), but divides just below the sinus, part running close

to the edge of the lamina on either side above the sinus. Thus, though the venation of *D. esculentum* is superficially similar to that of species of *Cyclosorus*, it is not identical and doubtless had a quite separate origin.

7. **Diplazium heterophlebium** (Mett.) Diels Nat. Pfl. 1, 4: 228. 1899. *Asplenium heterophlebium* Mett.; Baker, Syn. Fil. 243. 1867.

Stock short erect. Stipes slender, to 30 cm. long, glabrescent, when young clothed at the base with *thin entire brown scales* to about 1 cm. long and 1.5 mm. wide at the base. *Lamina to at least 35 cm. long and 25 cm. wide, the apical part (in young plants the whole lamina) deeply lobed, and below this a few pairs of adnate or sessile pinnæ.* Lobes of apical lamina falcate acuminate entire, to about 15 cm. long and 4 cm. wide; pinnæ to about the same size, their edges entire or more or less deeply undulate. Main lateral veins in the pinnæ pinnate, *the veinlets of adjacent groups anastomosing rather irregularly from about 1/4 distance from costa to margin,* the areolæ smaller towards the margin, with free short veins with thickened ends just within the margin. Sori of small fronds few, often one to each vein-group, on the basal acroscopic vein, often all simple but sometimes diplazioid; on larger fronds often several sori to each vein-group, some of them anastomosing with the veins. Texture thin, rachis and costæ glabrous or slightly scaly beneath with small narrow entire scales.

In Malaya, this species has only been found in the valley of the Bertam River, below Cameron Highlands, at 3,000–3,500 ft. altitude. The specimens there gathered differ from Himalayan specimens in having broader fewer pinnæ, all (or almost all) adnate to the rachis, with ampler venation and more irregular anastomosis. It is possible that fully grown plants have not yet been noticed. Further collecting in the valleys in the north of the main range will no doubt reveal more localities for this and other ferns of northern distribution which find their southern limit in Malaya. The thin pale entire scales show that this species is not closely related to *D. accedens*, though the anastomosing venation might lead one to think them allied.

8. **Diplazium insigne** Holttum, Gard. Bull., S.S., 9: 123. 1937.

Stock stout, short, erect. Stipes stout, c. 1 m. long, spiny towards the base, the spines 2 mm. long, each at first bearing a scale; scales dull brown 1.5 cm. long by 1.5 cm. wide at the base, with a narrow black toothed edge, deciduous. *Lamina to 1.5 m. long, bipinnate.* Lowest pinnæ about 28 cm. long and 6.5 cm. wide, narrowed and

stalked at the base, the margins lobed half-way to the costa, the apex acuminate. *Middle pinnæ largest, to 60 cm. long and 16 cm. wide, pinnate; pinnules slightly oblique, adnate to the rachis* (the lowest ones narrowly, the upper fully adnate and grading into the lobed apical lamina of the pinna), *to 9 cm. long and 2.3 cm. wide, cuneate at the base at an angle of about 45° on each side, narrowed gradually from the base and then suddenly at 1.5–2 cm. from the apex, margins slightly serrate; texture firmly herbaceous; veins anastomosing as in D. accedens.* Sori few or copious, the lowest acroscopic sorus in each vein-group usually diplazioid, and occasionally a few others also.

This species is evidently closely allied to *D. accedens*, and the apex of a frond might pass for that species, but its copious bipinnate form marks it as a quite distinct species. It is evidently similar to *D. Smithianum* from Ceylon, but appears to be much larger; probably both *D. Smithianum* and *D. insigne* are local derivatives of *D. accedens* (or *D. proliferum*).

Since the original description of *D. insigne* was published, I have discovered a collection made by Curtis on Taiping Hills at 2,000 ft. (No. 1352), labelled *D. Smithianum*, which is clearly *D. insigne*. Otherwise no new locality has yet been found for *D. insigne* except the type locality in a valley below Fraser's Hill (Pahang side).

9. *Diplazium Kunstleri* Holttum sp. nov. Fig. 2.

Rhizoma repens? Stipites ad 1 m. longi vel ultra, in sicco olivaceo-straminei, non muricati, basin versus squamis rotundatis peltatis deciduis muniti. Rachides læves, pallidæ, plerumque ad basin pinnarum superiorum proliferæ. Lamina bipinnata, ad 120 cm. longæ et 80 cm. lata vel ultra; pinnæ fere 12–jugatæ, infimæ leviter reductæ, superiores in lobos apicis laminæ sensim mutatae. Pinnæ maximæ c. 65 cm. longæ, c. 25 cm. latæ, in stipitibus 9 cm. longis stantes (stipites pinnarum superiorum sensim breviores). Pinnulæ infimæ inter se 5 cm. distantes; pinnulæ maximæ 16 cm. longæ et 3.5 cm. latæ, stipitatae 3 mm. vel ultra (ad 8 mm.), basi late cuneatæ vel truncatæ, apici acuminatæ dentatæ, cetera margine lobatæ 2/3 costam versus; lobi leviter obliqui, 5–7 mm. lati, basi dilatati, margine leviter serrati, apice rotundati; costulæ falcatae, squamis parvis latis peltatis paucis munitæ; venulæ in uno lobo 7–9–jugatæ, obliquæ, plerumque furcatæ (vel in pinnulis parvis simplicibus), utrinque distinctæ sed haud prominentes; lamina textura quam species affines crassior. Sori medium venularum solum occupantes; indusia angusta, in soris maturis haud evidentia.

TYPUS: Ginting Simpah, Selangor, 2,500 ft. alt., S.F.N. 31194, leg. Holttum.

Gardens Bulletin, S.S.

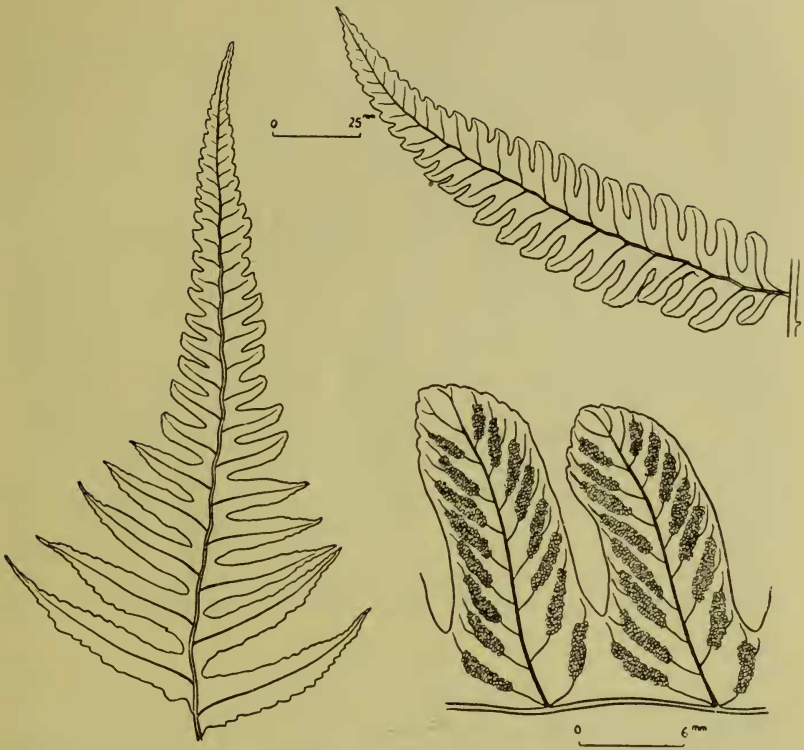


Fig. 2. *Diplazium kunstleri*, type. On left, apex of frond; on right, above, single pinnule from middle pinna; below, two fertile lobes.

D. Kunstleri is very distinct among the Malayan bipinnate species of *Diplazium* in the combination of the following characters: round peltate scales (otherwise found only in *D. latisquamatum*); pinnules cut more than half-way to the costa, with broad lobes; medial sori which never reach base or apex of the veins; and proliferous rachis. I found the type growing in a rocky streambed in shady forest.

The species is named after Hermann Kunstler ("King's Collector" of herbarium labels), who collected many interesting Malayan plants for the first time. He collected *D. Kunstleri* "near little stream, dense jungle", near Ulu Kerling, under No. 8797. Other collections in the Singapore herbarium are: 15th mile, Pahang Track, Ridley 8652; Rawang, Ridley 7843, 7852. Thus all specimens have been found on the Main Range in Selangor, at medium altitudes.

10. *Diplazium latisquamatum* Holtt. Gard. Bull., S.S., 9: 124. 1937. Fig. 3.

Stock short erect. *Stipes* to 90 cm. long, throughout or towards base only papillate with rather soft green papillæ, which in young fronds bear round or ovate, peltate, entire, nearly black scales, to about 5 mm. long and 3 mm. wide; old stipes and rachises bearing scattered small rounded scales only. *Lamina* to about 1.5 m. long and 1 m. wide, bipinnate-tripinnatifid. Largest pinnæ to about 60 cm. long and 23 cm. wide, shortly stalked, the basal pinnules slightly reduced, smaller on the acroscopic than on the basiscopic side. *Pinnules* sessile (or the basal ones on stalks to 2 mm. long), the largest about 12×2.5 cm. (commonly about 9×1.5 cm.), base broadly cuneate or subtruncate, gradually narrowed to acuminate toothed apex, margins lobed to within 2–3 mm. of the costa, lobes slightly oblique, mostly about 4 mm. wide, apex truncate, margins entire or slightly toothed near apex, texture thin but firm, costæ bearing scattered small ovate or rounded scales; veins pinnate in the lobes, the veinlets 5–6-jugate, simple or forked. *Sori* occupying only the lower half or less of the veins, the basal acroscopic sorus usually diplazioid, the others simple, the indusia thin, broad, persistent.

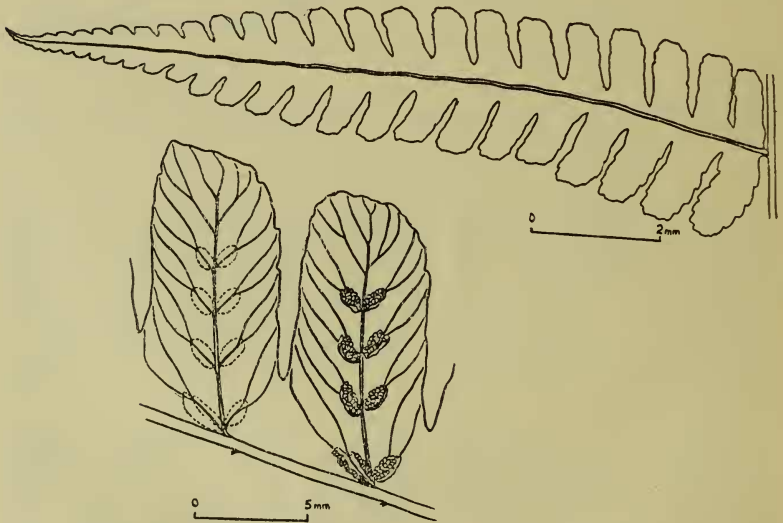


Fig. 3. *Diplazium latisquamatum*. Above, single pinnule from middle pinna. Below, two fertile lobes; the dotted outlines on the left hand lobe show the position of sori removed.

This species is very clearly distinguished from all others in Malaya by its almost round peltate entire scales and very short sori confined to the basal half of the veins. In general appearance, it resembles *D. procumbens*, but the scales of the latter, and its prostrate stem, distinguish it, even in sterile plants.

D. latisquamatum has been found in Malaya in shady forest by streams in the valleys of the Main Range at 4,000–5,000 ft. at Cameron Highlands and Fraser's Hill only. I have collected closely similar specimens in Sumatra, at 6,000–7,000 ft. altitude on Korinchi Peak. I am, however, in some doubt whether the Kinabalu (British North Borneo) specimens cited with the original description of the species should be regarded as identical; some have decidedly longer and more pointed scales, and pinnæ and pinnules broader.

The additional specimens from Malaya and Sumatra to be added to the list published in 1937 are:—

PAHANG. Fraser's Hill, 4,000 ft. S.F.N. 11007 (Md. Nur); S.F.N. 36504 (Holttum).

SUMATRA. Korinchi Peak 6,000–7,000 ft., Holttum s.n. 13/2/1933.

11. *Diplazium malaccense* Presl. Epim. Bot.: 86, 1849

Stock short erect. *Stipes* to c. 50 cm. long, clothed at base with entire brown scales which are 10–15 mm. long and 1.5–2 mm. wide at base, rest of stipe and rachis glabrescent, not fibrillose. *Lamina* pinnate, to about 60 by 30 cm. Pinnæ to about 20–jugate, below lobed apex of the lamina. Lower pinnæ on stalks 5 mm. long, bases very unequal, lower base often much cut away, upper truncate; upper pinnæ with base subequally truncate or broadly cuneate. Pinnæ thin in texture, drying rather light green, commonly to 16 cm. long and 2 cm. wide, apex acuminate, lobed not more than 2/3 way to the costa, lobes about 6 mm. wide at the base, a little more oblique than in *D. sorzogonense*, ends rounded to subtruncate and slightly toothed; veins up to 7 pairs in each lobe, all simple; sori from near base of veins to near margin of lamina, the acroscopic basal sorus usually but not always diplazioid. Surface not depressed below sori; indusium medium brown, thin but firm, usually turned back but not rolled as in *D. sorzogonense*.

A species of lowland and midmountain forest, found throughout Malaya, differing from *D. sorzogonense* (which grows in similar localities) in glabrescent stipe and rachis, less deeply lobed pinnæ, and sori not at all impressed. Specimens have been distributed under the names *D. silvaticum* and *D. speciosum*, both of which differ in having toothed scales.

A very large, perhaps monstrous, specimen was gathered by Mohamed Nur on Gunong Angsi (S.F.N. 11563). The apical part of the frond is quite like normal *D. malaccense*, but the middle and lower pinnæ are very large (to 8 cm. wide) and deeply lobed (almost to the costa), the lobes being falcate and acutely pointed, with forked lateral veinlets up to about 20 pairs. The bases of these pinnæ have 3 or 4 pairs of normal segments below the larger pointed segments.

12. *Diplazium montanum* v.A.v.R. Bull. Buitenz. II Ser., 28: 19. 1918.

Stock short erect. Scales on bases of stipes narrow, black, entire, to about 10 by 1 mm. Stipes black at the base, to about 60 cm. long. Frond simply pinnate. Pinnæ to about 20—jugate, to about 18 by 2 cm., the lower ones on stalks to 4 mm. long, upper sessile, the apical pinna like the others (occasionally with one or two $\pm$ separate round lobes at the base); upper pinnæ unequally cuneate at the base; lower pinnæ with upper base narrowly rounded, lower base narrowly cuneate; edges of pinnæ toothed, apex acuminate toothed, texture thin; veins forked at or near base, the acroscopic branch soriferous, simple, the lower branch simple or sometimes forked, occasionally bearing a short sorus. Sori on the acroscopic veinlet mostly simple, but occasionally diplazioid, reaching from the costa almost to the edge of the lamina.

This species differs from *D. pallidum* Bl. in having the apical pinna like the others (in *D. pallidum* the apical lamina of the frond is deltoid and deeply lobed), and in having the lower pinnæ with much narrower bases (in *D. pallidum* the lower pinnæ have a broadly truncate upper base). It appears also that *D. pallidum* has fertile fronds from a young stage of development, whereas *D. montanum* does not produce fertile fronds until the plants are full grown.

D. pallidum occurs in Sumatra on the higher parts of the mountains, matching Java specimens exactly; *D. montanum* appears to occur at lower levels in Sumatra, thus falsifying its name. In the Peninsula *D. pallidum* does not occur. *D. montanum* occurs in forest at low and medium elevations.

Specimens in Singapore Herbarium:—

PAHANG. Tahan River, Ridley 2167. Tembeling, S.F.N. 24703 (Holtum). Buloh Telang, P. Tioman, 800 ft., S.F.N. 18583 (Henderson).

PERAK. 2,000–2,500 ft., King's Collector 10959. Sungei Siput, Haniff 4047. Ulu Temango, Ridley 14209.

SUNGEI UJONG. Hullett s.n. Aug. 1880.

SELANGOR. Batu Caves, Ridley 8139.

SUMATRA (East Coast). Region of Marban, Bilah, near Bilah Pertama, Rahmat si Toroes 145,221 (distr. Univ. of Michigan).

SIAM. Patani, 210-350 m., on rock in stream, Eryl Smith 1948.

13. **Diplazium polypodioides** Bl. Enum. 194. 1828.

D. asperum Bl. Enum. 195. 1828.

Stock stout, erect, often subarborescent; stipes stout, to 1 m. long, clothed thickly at the base with *narrow scales of thick texture, dull brown with narrow black toothed edges*, to about 4 cm. long and 2 mm. wide at base, usually not more than 1 mm. wide over the greater part of their length; *the scales attached to protuberances on the stipe which remain as more or less short prickles up to 1 mm. or rather more in height*. *Lamina bipinnate*, deeply tripinnatifid, *commonly about 100 cm. long and 60 cm. wide*, sometimes much larger, largest pinnæ to about 85 by 30 cm., commonly less, shortly stalked, with 20-30 pairs of pinnules below the deltoid lobed apex of the pinna. Largest pinnules to 16 by 3.5 cm., commonly about 9 by 2 cm. or sometimes less, sessile or the lowest shortly stalked, base truncate or very broadly cuneate, apex acuminate, *edges cut into lobes $\frac{3}{4}$ or more towards the costa*; lobes slightly oblique, subtruncate or bluntly pointed, *their margins sharply toothed throughout, 2-5 mm. wide*, veins 7-12 pairs in each lobe, usually simple, forked in the largest lobes; texture thin to firm. Rachises and costæ usually glabrescent, the costæ sometimes with small narrow scales; rachises, like the stipes, often slightly prickly with the bases of fallen scales. Costæ above distinctly winged, the wing interrupted and sometimes dilated at the base of each costule. Sori usually present on almost all veins, from the base half-way or more to the edge, the indusia thin but persistent; on short narrow lobes with close veins the sori may be almost confluent.

The long narrow black-edged toothed scales, the usually prickly stipes, and the deeply cut narrow toothed lobes are characteristic of this species.

SELANGOR. Klang Gates, F.D. 14602 (Ingram).

Ginting Simpah, 1,500 ft., Hume 8551B (Herb.

F.M.S. Mus.), S.F.N. 9982 (Burkill).

NEGRI SEMBILAN. G. Angsi 950 ft. S.F.N. 11515

(Md. Nur). Senaling Inas F.R., in small clearing, S.F.N. 9770 (Holtum).

PENANG. N. of Western Hill, 2,000 ft., S.F.N. 19776

(Holtum). Penara Bukit, 2,000 ft., S.F.N.

19342 (Holtum). No loc., abundant, C. Curtis 10135.

PERAK. Ulu Temango, Ridley 14206. Ulu Bubong, King's Collector 10849.

PAHANG. Raub, S.F.N. 14103 (Best). Telom, Ridley 13975. Kuala Tahan, Ridley 2,400. S. Sat, S.F.N. 22089 (Henderson). Robinson Falls, 4,000 ft., S.F.N. 23262 (Holtum). Boh Plantations, 4,000 ft., S.F.N. 32937 (Md. Nur). C. Highlands, 5,000 ft., S.F.N. 23518 (Holtum) S.F.N. 31295 (Holtum) ; 4,800 ft., S.F.N. 23361 (Holtum).

In Malaya, this species is common by the edge of forest in moist ground, especially by streams, never in the heavy shade of high forest. It is especially characteristic of the mountains between 2,000 ft. and 4,000 ft., occurring abundantly by roadsides, but occurs also in low country and at higher elevations. In very moist slightly shaded situations in mountain valleys it sometimes attains a very large size, with broader and thinner leaflets than commonly, but I cannot see any clear specific distinction between these and the smaller leaves of firmer texture. The upper parts of larger fronds are much like the smaller fronds.

I have not examined any Indian specimens, and I do not know how far the specimens described by Beddome as *D. polypodioides* and *D. asperum* would agree with Malayan plants. *D. polypodioides*, as I understand it, is certainly a very widely distributed species. I have seen specimens which I would so name from N. Siam, Hainan, the Philippines and New Guinea.

As regards the identity of Blume's two species, *D. asperum* and *D. polypodioides*, I follow both Raciborski and the recent work of Backer and Posthumus in uniting them, using the name *polypodioides*, though I think it is a pity that the more appropriate name *asperum* was not chosen. Van Alderwerelt van Rosenburgh suggested various differences between Blume's two species, but I do not find that these differences are constantly associated in Peninsula specimens. As above noted, habitat appears to have a considerable influence on size and other characters.

14. **Diplazium Prescottianum** (Wall.) Moore, Index 156. 1859. *Aspidium Prescottianum* Wallich, Catalogue No. 235 (nomen) ; Hooker, Spec. Fil. 3: 251. 1860.

The type of this species was collected in Singapore, and agrees with the other Singapore specimens quoted below. These may be described as follows. *Scales* on bases of stipes brown, entire, about 1.5 mm. wide at base. Pinnæ to about

14-jugate below the lobed deltoid apex of the lamina, texture firm. *Lowest pinnæ on stalks to 6 mm. long, upper sessile or adnate.* Lower pinnæ to 24 cm. long and 1.8 cm. wide, base unequal, rounded above, rounded or cuneate below; upper pinnæ with broadly cuneate auricled upper base, and narrowly cuneate lower base. *Edges of pinnæ crenate or slightly lobed, lobes slightly toothed or entire, the auricle at the base of the upper pinnæ more or less separated by a sinus from the rest of the pinna* (in the type with a few similar lobes following it, cut nearly to the costa). *Veins of largest pinnæ in pinnate groups, 3-4 veinlets on each side of the main vein, 4-6 veins in each group soriferous, sorus on basal acroscopic vein diplazioid, others not; sori from near base of vein to near margin.*

The other specimens differ in the width of the pinnæ, which are up to 3.3 cm. wide, and some of them in the entire lack of an auricle on the upper base of the upper pinnæ. All agree in the character of the scales, the stalks of lower pinnæ, the slight lobing or crenation of the edges of the pinnæ, and the number of veins and sori in each group. The species appears to be related to *D. montanum* v.A.v.R. (and *D. pallidum* Bl.), but differs in larger brown scales, more lobed edges to pinnæ, and many more soriferous veins in each group. From *D. subintegrum* it differs in shorter pinna-stalks, more lobed edges, more veins and sori in each group.

Specimens in Singapore Herbarium:—

SINGAPORE. Between Bukit Panjang and Woodlands, Matthew; Toas, Ridley s.n. 1892.

SELANGOR. Ginting Simpah, Hume, F.M.S. Mus. 9665, 9347, 8997, 9677.

PERAK. Kinta, 1,500-2,000 ft., Kunstler 7146. Larut, 2,000-3,000 ft., Kunstler 2391. Kinta, Curtis 3369.

SIAM. Patani, 540-700 m., Eryl Smith 1930; 260 m., Eryl Smith 1927. Koh Chang, Marcan 1268.

15. *Diplazium procumbens* Holttum sp. nov. Fig. 4.

Rhizoma procumbens, c. 1 cm. diametro. Stipites ad 80 cm. longi, in sicco sordides vel straminei, glabrescentes, basibus squamarum deciduarum leviter asperuli, in juventute squamis parvis lineari-lanceolatis, fuscis, margine leviter dentatis (non nigris) vestiti. Lamina deltoidea, bipinnata, ad c. 80 cm. longa et c. 80 cm. lata; pinnæ maximæ 50 cm. longæ et 20 cm. latæ. Pinnulæ sessiles vel infimis stitipatæ (stipites 3 mm. longi), maximæ 2.5 cm. latæ, basi truncatæ, apice acuminatæ, $\frac{3}{4}$ ad costam lobatæ; lobi maximi basi 7 mm. lati, oblongi, cum costa angulum fere rectum formantes, apice rotundati, margine apicem

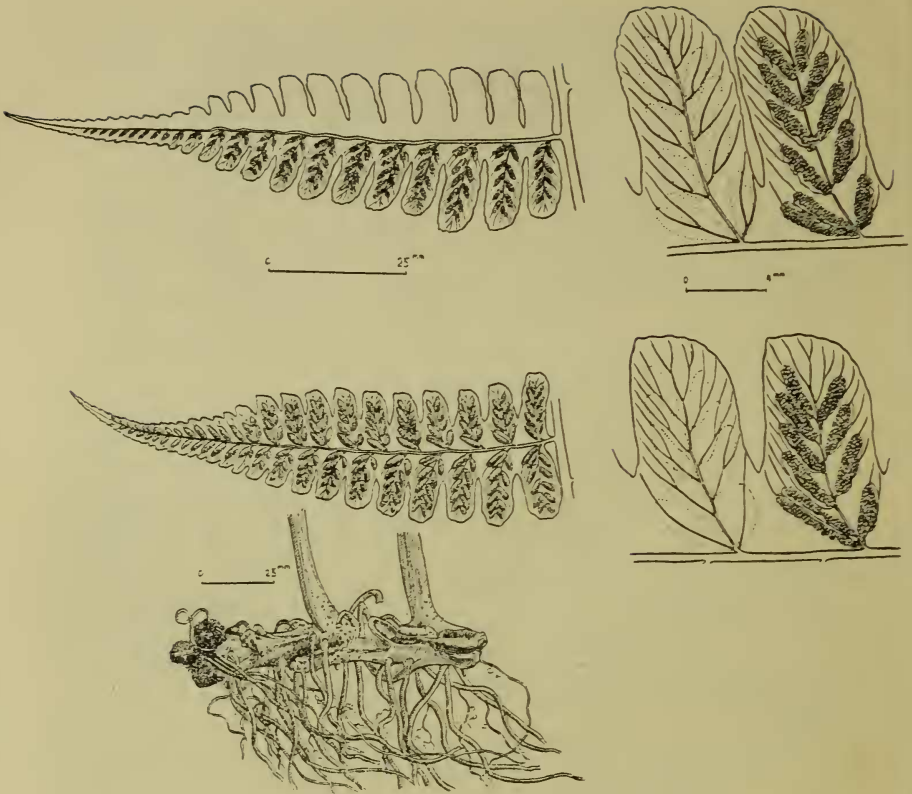


Fig. 4. *Diplazium procumbens*. On left, pinnules from different fronds, and on right enlarged portions of each to show veins and sori. Below, the procumbent rhizome.

versus leviter dentati. Venulæ ad 7-jugatæ, in lobi maximi omnes furcatæ, in lobi parvi plerumque simplices, costæ squamulis paucis parvis lanceolatis brunneis dentatis munitæ. Sori e costa in $1\frac{1}{2}$ – $2\frac{1}{3}$ longitudine venularum sedentes, sorus infimus acroscopicus plerumque diplazio-deus; indusia tenuia membranacea.

TYPUS: Fraser's Hill, 4,000 ft., S.F.N. 36503 (Holtum).

This species resembles *D. latisquamatum* in appearance, but differs in its narrow slightly toothed scales (round and entire in *D. latisquamatum*), procumbent rhizome, hardly muricate stipes, usually broader, more acuminate pinnæ, more copiously forked veins and longer sori with very thin indusia. It is abundant in the moist shady valleys, near streams, on the Pahang side of the divide at Fraser's Hill, and has not yet been found elsewhere.

Specimens in Singapore Herbarium:—

Fraser's Hill, 4,000 ft., S.F.N. 8844 (Burkill & Holttum), S.F.N. 11478 (Holttum), S.F.N. 21645 (Holttum), S.F.N. 37201 (Addison), s.n. Corner 12.8.37.

16. *Diplazium riparium* Holttum sp. nov. Fig. 5.

Rhizoma breve erectum. Stipites ad 50 cm. longi, in vivo virides, in sicco brunnei fusci, basi squamis lanceolatis, fere nigris, integris, 4–5 mm. longis, 1.5 mm. latis, vestiti, cetera nudi. Lamina pinnata, pinnæ laterales ad 5–jugatæ (superiores nonnunquam leviter adnatæ), pinna terminalis

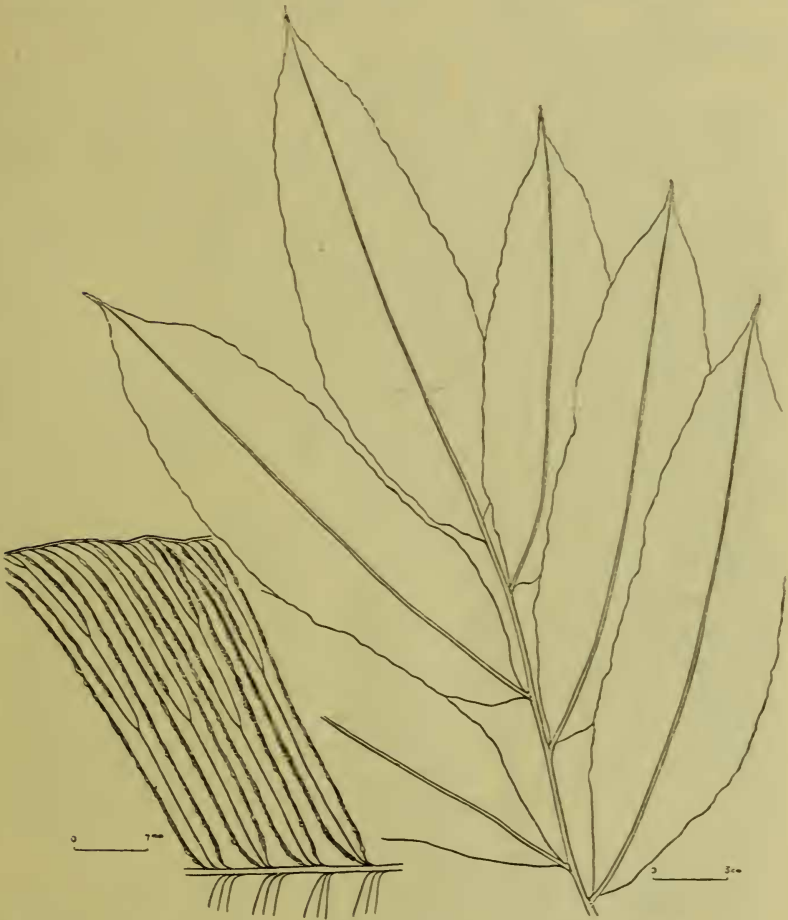


Fig. 5. *Diplazium riparium*, type; outline of frond. On left, below, detail of venation and sori, enlarged.

ceteris similis, rachis non prolifera. Pinnæ maximæ ad 29 cm. longæ et 7 cm. latæ, brevissime stipitatæ vel sessiles, basi subæqualiter cuneatæ, margine fere integræ, apicem versus subito angustatæ et plus minusve caudatæ, cauda ad 2 cm. longa; costa subtus rotundata, in sicco brunnea vel fusca, nuda, supra in sicco canaliculata; venæ angulum plus quam 60° cum costa formantes, rarissime anastomosantes, in fasciculis parvis glomeratæ; fasciculus ex venis tribus constatus, vena medialis furcata (sæpe bis furcata); sori 3-4 pro fasciculo, sori venarum lateralium e costa fere ad marginem extensi, ceteri breviores, omnes prope marginem terminati.

TYPUS: Selangor, Semenyih, Hume 8186 (Herb. F.M.S. Mus.).

This species agrees with *D. xiphophyllum*, as I understand it, in Malaya, in its entire scales and rather large subentire pinnæ. It differs from *D. xiphophyllum* in the following characters: stipe and rachis darker when dry (stramineous in *D. xiphophyllum*); scales shorter, darker; fronds much shorter; pinnæ to about 5 pairs only, shorter and broader, almost or quite entire on old plants; anastomosis of veins rare, veins at more than 60° to midrib in mature plants, the ends of the veins uniting with a cartilaginous margin; rachis not gemmiparous.

Young plants have the first fronds simple, later fronds with one or more pairs of lateral pinnæ, which have distinctly toothed margins, especially towards apex, fertile from an early stage (on pinnæ from 9×2 cm.), the lateral veins often making a smaller angle to the midrib than in the larger pinnæ of mature plants.

This is a fern of the lowlands only, in forest near streams, usually in wet places and often on stream banks. It has also been found in the low country of E. Sumatra and Sarawak. It has usually been referred to *D. bantamense*, from which it differs in its entire scales and lack of buds on the rachis, also in young plants not having hastate or cordate fronds. It also resembles *D. Donianum*, but this also (so far as specimens available indicate) has toothed scales. It may be very near *D. alternifolium* from Java, but appears to differ in more entire pinnæ and in fewer veins in each group (*D. alternifolium* has usually 3 pairs of lateral veins in each group, often all soriferous); I have not seen scales of *D. alternifolium*.

Specimens in Singapore Herbarium:—

PERAK. Upper Perak, 300 ft., L. Wray Jr. 3590 (young), 3650. B.P.D. 300-500 ft., King's Collector 7894.

PAHANG. Near K. Teku, 500 ft. (young plant), S.F.N. 20792 (Holtum); S. Cheka, young plant, S.F.N. 24780 (Holtum); Mentakab, West, S.F.N. 24558 (Holtum).

KELANTAN. Ulu S. Ketch, Md. Nur, s.n. 14.2.24.

TRENGGANU. K. Brang, S.F.N. 15323 (Holtum).

SELANGOR. Semenyih, Hume, F.M.S. Mus. No. 8186 (Type).

MALACCA. Ayer Keroh, Ridley s.n. Dec. 1899. Ayer Panas, Ridley 1587.

SUNGEI UJONG. No loc., Alvins 3282.

JOHORE. Ulu Sedili, Holtum, s.n., May 1932; foot of G. Panti, 200 ft., S.F.N. 18301 (Holtum).

SINGAPORE. Hullett s.n. Jan. 1881.

SUMATRA. East Coast, general region of Marbau, Rahmat si Toroës 222.

SARAWAK. No loc., Bishop Hose s.n., 1890.

17. **Diplazium silvaticum** (Bory) Sw. Syn. Fil. 92. 1806.

Callipteris silvatica Bory, Voy. 1: 282. 1804.

Stock short, erect. Scales on young fronds and bases of stipes very dark, to about 10 mm. long and 1.5 mm. wide, closely and distinctly toothed, teeth often forked (see fig. 1). Stipes to about 40 cm. long. Frond simply pinnate, to about 50 by 20 cm., pinnæ numerous, lower stalked to about 5 mm., upper sessile; lowest pinnæ with upper base subtruncate, lower base cuneate; upper pinnæ with base broadly cuneate to truncate, more or less auricled above but not below; pinnæ to about 12 cm. long and 3 cm. wide (commonly less), apex acuminate, edges lobed to about $\frac{1}{4}$ distance to costa, texture thin; lobes oblique, about 5 mm. wide, veins in pinnate groups with 3-4 pairs of lateral veins; sori from near base of veins $\frac{3}{4}$ or more towards edge, sorus on acroscopic basal vein diplazioid, sometimes sorus on next acroscopic vein also, other sori simple.

This species, which I believe I have correctly identified, occurs throughout Malaya, but is not always easy to distinguish from *D. crenatoserratum*. It differs from *D. crenatoserratum* in having broader pinnæ of thinner texture, not auriculate on the lower base, and by the larger and closely and distinctly toothed scales, the teeth often forked. Some specimens approach *D. malaccanum* in appearance; they are distinguished by their toothed scales (scales of *D. malaccanum* are entire).

D. silvaticum was originally described from Mauritius. Malayan specimens, according to Christensen (Dansk Bot. Ark. 7: 82. 1930), are very close to the type. This must be reckoned one of the most widely distributed species of the genus. Ceylon specimens in the Singapore herbarium

have scales like Peninsula plants, but have more ample fronds than any Malayan specimens. How far eastwards the species extends, I do not know. A Java specimen in the Singapore herbarium (quoted below) agrees quite well with Peninsula specimens.

Specimens in Singapore Herbarium:—

SINGAPORE. Hullett s.n. (2 sheets).

PAHANG. Tahan River, Ridley 5818. S. Cheka, Holttum s.n., 26.4.31. Tembeling, S.F.N. 24704 (Holttum). Base K. Glanggi, S.F.N. 22422 (Henderson).

SELANGOR. Woods Batu Caves, Ridley s.n., Dec. 1891 (?). Klang Gates, F.M.S. Mus., Hume 7117.

PERAK. Upper Perak, 300 ft. Wray 3626, 3594. Gapis Pass, Curtis 1360.

KELANTAN. Gua Panjang, Gua Ninik, S.F.N. 19498 (Henderson).

KEDAH. Langkawi, G. Raya, Curtis s.n., Sept. 1890. 48 mile Jeniang Road, S.F.N. 35995 (Kiah).

JAVA. Djember, inter G. Boto et Tjuramamis, 600 m., Backer & Posthumus s.n. 11.3.29.

SIAM. Chawng ($7^{\circ} 35'$), S.F.N. 24382 (Kiah, doubtful). Betong, Patani, 440 m., Eryl Smith 1929.

18. *Diplazium simplicivenium* Holttum sp. nov. Fig. 6.

Rhizoma breve erectum. Stipites 1 m. longi vel ultra, basin versus basibus squamarum deciduarum asperuli; squamæ 2 cm. longæ vel ultra, prope basin 1–2 mm. latæ, fuscae, marginæ dentatæ, dentes simplices. Lamina 1.5 m. longa et 1 m. lata vel ultra, bipinnata. Pinnæ adjacentes c. 15 cm. inter se distantes, obliquæ; pinnæ maximæ 65 cm. longæ et 20 cm. latæ; pinnulæ liberæ ad 20–jugatæ, sub apicem lobatum laminæ; pinnulæ maximæ 12 cm. longæ, 2 cm. latæ, fere sessiles, basi truncatæ (non auriculatæ), apicem versus acuminatæ, e margine $\frac{1}{4}$ costam versus lobatæ; lobi truncati, c. 7 mm. lati, leviter obliqui; venæ c. 5–jugatæ, omnes simplices; sori e basi venarum $\frac{3}{4}$ vel ultra marginem versus extensi; textura laminæ tenuis, venæ utrinque distinctissimæ; costæ subtus (plerumque basin versus) squamis parvis paucis brunneis, margine fere nigris, munitæ.

TYPUS: Fraser's Hill, 4,000 ft. alt. S.F.N. 36507, leg. Holttum.

This species differs from *D. dilatatum* in the following characters: wider and longer scales of coarser texture; veins all simple (some may be forked on transition pinnæ near apex of frond, but none on the typical larger pinnæ, even

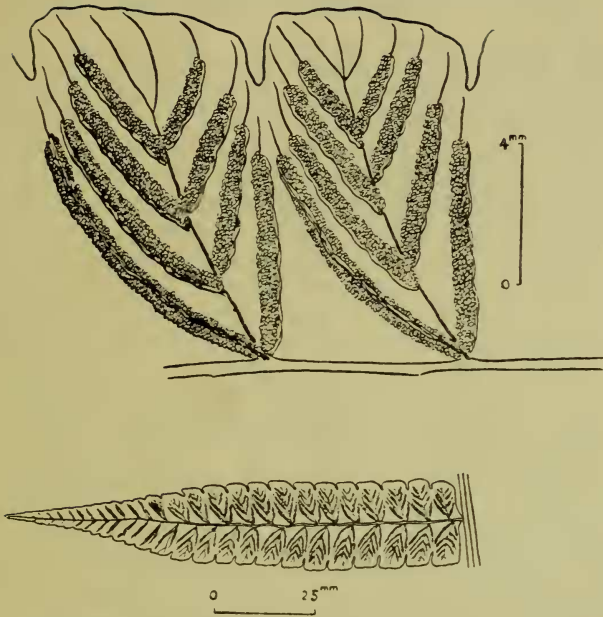


Fig. 6. *Diplazium simplicivenium*. Below, single pinnule from large pinna. Above, two lobes enlarged to show venation and sori.

of very large fronds); usually not more than 5 pairs of veins; sori occupying $\frac{3}{4}$ or more of the length of the veins.

D. simplicivenium occurs in moist shady valleys near streams; it has been found on the Main Range, the Taiping Hills, and on G. Senyum in Pahang, also in Lower Siam. Some specimens from Borneo agree in having simple veins, but they have much wider pinnules than Peninsular specimens and I doubt their identity with this species.

Specimens in Singapore Herbarium:—

PERAK. No loc. Hullett s.n., 1881. Larut, 1,000–1,500 ft., King's Collector 2346; 1,500–2,000 ft. King's Collector 2214. Temango, Ridley 14211. G. Bubu, 600–800 ft., King's Collector 8420.

PAHANG. Tras Valley, 3,800 ft., S.F.N. 21636 (Holttum). Base of G. Senyum, S.F.N. 22388 (Carr).

SELANGOR. Ginting Simpah, Hume 9110 (F.M.S. Mus. Herb.).

LOWER SIAM. Khaw Poh Hill, Khsum, 1,200 ft., S.F.N. 3829 (Haniff & Nur).

19. **Diplazium sorzogonense** Presl, Tent. Pterid.: 114. 1836
Asplenium sorzogonense Presl, Rel. Hænk. 1: 45.
 1825.

Stock short erect. Stipes to c. 60 cm. long, scaly at base with long narrow entire scales, scales dark brown, sometimes with black edges, to about 1.5 cm. by 1.5 mm.; rest of stipe and rachis scaly with very narrow dark hair-like scales. Lamina simply pinnate, to about 80 by 40 cm., pinnæ to c. 20-jugate below pinnatifid apex of frond; lower pinnæ very shortly stalked, upper sessile, bases truncate or subtruncate, apices acuminate, margins lobed $\frac{3}{4}$ or more to costa in lower pinnæ, less deeply in upper ones; lobes almost at right angles to costa, oblong, ends rounded and slightly toothed, 4–6 mm. wide above base; texture firm, drying rather dark; largest pinna to 25×5 cm., commonly less, veins in the lobes to about 10 pairs, all simple, basal $\frac{1}{4}$ usually free of sori; sori reaching almost to margin, the lamina below the sorus depressed, the depression with a distinct margin on the dried frond. Sori usually all simple near the base of a pinna, the acroscopic basal sorus of each lobe diplazioid towards apex of pinna. Indusia firm, persistent, rolled back when sorus is mature.

This species is found throughout Malaya, in lowland and mountain forest to 4,500 ft. altitude. It is a very widely distributed species, and though somewhat variable is always recognizable by the fibrillose stipe and rachis and the peculiar impressed sori, which I have not found in any other *Diplazium* of this region (except slightly in *D. subserratum*).

D. sorzogonense differs from *D. speciosum* in having entire scales, fibrillose rachis, and in the impressed sori. I think that the two species have sometimes been confused.

Specimens in Singapore Herbarium:—

SINGAPORE. Stagmount, Ridley s.n., 1907; Ridley 11271. Bukit Timah, Ridley s.n. 1897. Mandai Road, Corner s.n., 20.10.29.

PERAK. Kinta, 1,500–2,000 ft., King's Collector 7151. Taiping, Scortechini, March 1884. Tapah, Ridley 14023.

SELANGOR. Kwang, Ridley 13432.

PAHANG. Fraser's Hill, 4,000 ft., S.F.N. 11198 (Md. Nur); s.n., Holttum 20.3.29; s.n., Holttum 31.12.39. Cameron Highlands, 4,500 ft., s.n., Holttum 21.5.36. G. Rokam, P. Tioman, 2,000 ft., S.F.N. 18612 (Henderson).

PENANG HILL s.n. Dec. 1831, Hullett. S.F.N. 19302 (Holttum).

KEDAH. G. Lang 2,000 ft., S.F.N. 35012 (Kiah).

20. *Diplazium speciosum* Bl. Enum. 193. 1828.

Stock short erect. Stipes to 60 cm. long, clothed at the base with *shining brown scales with toothed but not blackened edges, about 1.5 cm. long and 1.5 mm. wide at base; rest of stipe and rachis glabrescent.* Lamina pinnate, to about 70 × 25 cm., pinnæ to about 20-jugate, to 20 cm. long and 3.5 cm. wide, lower pinnæ on stalks to 4 mm. long, upper sessile, base truncate (on lower pinnæ sometimes narrow), apex acuminate, *margins lobed more than $\frac{3}{4}$ way to costa in lower pinnæ; lobes 4-5 mm. wide above base, slightly oblique, oblong, ends rounded, edges shortly toothed, texture firm, drying rather dark brown; veins to 10 pairs in each lobe, simple, sori from base of veins over $\frac{2}{3}$ their length, not impressed, often all simple, the indusia thin but firm, not rolled back when sorus is ripe.*

In Malaya this species has only been found on G. Tahan, specimens from which differ from Kinabalu specimens in wider lobes of the pinnæ; Peninsula specimens agree however with that from Mt. Dulit, Sarawak, quoted below.

D. speciosum has much the general appearance of *D. sorzogonense*, but lacks the fibrillose scales on stipe and rachis, has toothed scales at the bases of the stipes, and has sori not impressed. The lobes of the pinnæ are also rather more deeply cut and more strongly toothed.

Specimens in Singapore Herbarium:—

PAHANG. Gunong Tahan, Ridley 15991; 5,000 ft., Haniff & Nur. S.F.N. 7953; 4,500 ft., S.F.N. 20747 (Holttum).

BORNEO. Dulit, C. Hose, Herb. Bishop Hose. Kinabalu, 5,000 ft., S.F.N. 25444 (Holttum).

Var. *major* (Bedd.) Holttum stat. nov.

D. sorzogonense v. *major* Bedd. Suppl. 40. 1892.

Differs from the typical form of the species in having fronds to 1.50 m. long, pinnæ to 6.8 cm. wide, the lobes more acute and more strongly toothed, veins to 13 pairs, mostly forked.

PERAK. G. Bubu, 5,000 ft., King's Collector 7403 (type of variety); G. Bubu, 5,000 ft., Wray 3862.

PAHANG. Pine Tree Hill, 4,500 ft., S.F.N. 36508 (Holttum).

SUMATRA. G. Sibayak, 5,000 ft., S.F.N. 15457 (Holttum).

The type of Beddome's variety clearly belongs to this species and not to *D. sorzogonense*. It is a very fine fern and might perhaps rank as a species.

21. *Diplazium subintegrum* Holttum, Gard. Bull. S.S. 9: 125. 1937.

Stock short erect. *Scales on stipes brown, entire, to about 1.5 cm. by 2 mm. Stipes to 80 cm. long, pale when dry. Frond simply pinnate, to about 70 cm. long; pinnae to about 16 pairs, the apical lamina narrowly deltoid, lobed at the base. Pinnae to 24 by 2.5 cm., lowest stalked to 1.5 cm., upper 2 or 3 pinnae only sessile; bases almost equal, of lower pinnae narrower, cuneate; edges toothed, apices acuminate. Veins forked near the costa, the upper branch always simple, the lower branch forked 1-4 times; sori on upper branch from base $2/3-3/4$ of way towards margin, diplazioid, usually also on one branch only of the lower vein, simple.*

A mountain species, related to *D. montanum* and *D. pallidum*, differing from the latter in larger brown scales, longer stalks and narrower bases of pinnae, more branched veins and normally diplazioid sori; differing from *D. montanum* also in the narrowly deltoid lobed apex of the lamina. This species appears to be confined to the Main Range of the Malay Peninsula and the Taiping Hills, at 3,000-5,000 ft. The specimens in the Singapore Herbarium were cited with the original description quoted above; no more have since been acquired.

22. *Diplazium subserratum* (Bl.) Moore, Index 338. 1862.
Asplenium subserratum Bl. Enum. 174. 1828.

Stock slender, erect or decumbent. *Stipes slender, clustered, 10-20 cm. long, glabrescent, clothed when very young with small very dark scales, 2-3 mm. long and less than 1 mm. wide, the edges very shortly toothed. Lamina simple, to about 50 cm. long and 4 cm. wide, narrowed gradually to the base which is suddenly contracted from a width of a few millimetres, and very gradually to the acuminate apex; margins entire or irregularly undulate, toothed towards apex; texture very firm. Midrib grooved above, prominent beneath and bearing scattered dark brown ovate-lanceolate scales 1 mm. long or less; scales also on some of the lateral veins beneath. Veins in small groups at an angle of about 60° to the midrib, the groups about 5 mm. apart. Each vein-group formed by forking at the midrib, the acroscopic branch being simple and the lower forked 2-4 times again; the simple acroscopic branch usually sori-ferous and often one, more rarely two, branches of the basiscopic vein also. Sori on acroscopic vein diplazioid, varying in length, often from the base almost to the edge of the lamina; other sori simple and shorter; indusia firm,*

persistent, when old rolled back as in *D. sorzogonense*, and leaving a faint mark on the lamina to show their size and position when young.

This species in Malaya is confined to moist shady mountain valleys, near streams. It is the only Malayan species with narrow simple fronds, and so is easy to recognize. Young plants have fronds which are dissected to the midrib, indicating a probable origin from a pinnate ancestor. The resemblance of the indusia to *D. sorzogonense* is interesting.

D. subseriatum is probably allied to *D. lanceum* of India and China, but is larger, and has a shorter rootstock which is more or less erect with tufted fronds; the scales also appear to be smaller.

23. *Diplazium tomentosum* Bl. Enum. 192. 1828.

Stock short, erect. Scales on stipes to about 4 mm. long and $\frac{1}{2}$ mm. wide, acuminate, dark to medium brown, the edges irregular but hardly toothed. Stipes to c. 40 cm. long, frond to about 35 by 15 cm., pinnæ many, lowest shortly stalked (to 3 mm.), upper sessile or adnate; lowest pinnæ largest, somewhat deflexed and curved, widest $\frac{1}{3}$ from base, base narrow, apex acuminate, to 3 cm. wide; middle and upper pinnæ narrower, with parallel sides, almost at right angles to rachis, slightly curved, base truncate, auricled above, broadly cuneate below. All pinnæ of large fronds deeply lobed (half way or almost to the costa), lobes c. 3 mm. wide above the base, at an angle of less than 60° to the costa, their edges slightly toothed at the tip. Veins pinnate in the lobes, the veinlets usually forked, up to 7 pairs or more, often all or almost all veins soriferous, the lowest acroscopic vein with sorus directed towards the main costa or diplazioid. Texture firm, drying very dark; rachis and costæ beneath densely covered with short multicellular hairs with pale cells and dark brown cross-walls.

Young plants have almost entire pinnæ; these approach *D. crenatoserratum* in appearance but are distinguished by their more hairy rachis and costæ beneath, usually narrower more pointed pinnæ, more deflexed, shorter-stalked lowest pinnæ which are broadest near the middle, and darker colour on drying. Fully developed plants, with their deeply lobed pinnæ and deflexed almost elliptical lowest pinnæ are quite distinct.

D. tomentosum is closely related to *D. velutinum*, a mountain plant with more deeply dissected, though hardly larger fronds. The tomentum of both is of the same character.

D. tomentosum is a common species in lowland and mid-mountain forest throughout Malaya; it seems unnecessary to enumerate all the many specimens.

24. **Diplazium velutinum** Holttum Gard. Bull. S.S. 9: 126. 1937.

Caudex short erect. *Stipes* to 40 cm. long (commonly about 20 cm.), *clothed throughout with scattered multicellular brown hairs*, and towards the base with narrow almost black entire scales, scales to about 1 cm. long and barely 1 mm. wide at the base. *Lamina bipinnate, to about 25 cm. long and 15 cm. wide, the rachises and costæ beneath densely clothed with brown hairs* like those on the stipe, with a few small narrow scales. Free pinnæ 12–15 pairs, the sub-basal largest, the upper ones gradually reduced and grading into the lobed apical lamina. *Largest pinnæ c. 8 cm. long and 3 cm. wide* (commonly about 6 by 2 cm.), subsessile, narrowed from truncate base to acute or acuminate apex, *pinnate towards the base only*, for the rest lobed almost to the costa, the pinnules or segments at right angles to the pinna-rachis at the base, gradually more oblique towards the apex. Free pinnules few, the rest more or less broadly adnate to the pinna-rachis; *largest pinnules about 12 mm. long and 4 mm. wide, base unequally cuneate, margins serrate or lobed* as much as half-way to the costule, apex rounded, texture very firm. Veins in pinnules or pinna-lobes 7–10–jugate, mostly forked; sori on basal $\frac{1}{2}$ – $\frac{2}{3}$ of veinlets; in the largest pinnules several diplazioid sori, in smaller pinnules only one such sorus; indusia thin, broad, persistent.

This species, closely related to *D. tomentosum* but much more deeply dissected, has hitherto only been found in the moist shady valleys at Cameron Highlands, 4,800–5,000 ft. above sea level. No further collections have been made since my paper above quoted.

25. **Diplazium xiphophyllum** (Baker) C. Chr., Ind. Fil. 241. 1905.

Asplenium xiphophyllum Baker, J. Bot. 1879: 40.

Stock short, erect. *Stipes* to 70 cm. long, *drying pale*, clothed at the base with *dull brown entire scales to 1.5 cm. long and 2 mm. or more wide* at the base. Lamina simply pinnate; *pinnæ in adult plants to 12 pairs*, terminal pinna like the rest, *texture thin, colour light green when fresh, light brownish when dry*; lower pinnæ on very short stalks (2 mm. long), uppermost slightly adnate to rachis, *with buds sometimes in their axils*. *Largest pinnæ to about 35 by 6 cm.*, elliptical, narrowed gradually to the slightly unequal base and more abruptly to the acuminate-caudate

apex; *edges slightly and irregularly toothed throughout*; midrib pale, prominent and glabrous beneath, *lateral veins in small groups, at 45° to the midrib*, commonly of one basal pair and one central vein which is forked, one or both of its branches also forked; *veins occasionally anastomosing near margin but never copiously anastomosing, ending distinctly within the margin* and not united to it. Sori on basal pair of veins in each group, from near midrib to near margin, on other veins shorter, commonly 3–4 sori on each vein-group, the sorus on the anterior basal vein only diplazoid.

The above description applies to ferns found in the Malay Peninsula. The type of the species *D. xiphophyllum* is from Borneo (Labuan, coll. Burbidge, at Kew), and shows a frond of a young plant with narrow pinnæ, and detached pinnæ from a mature plant, these being 30 by 3 cm. There is therefore some doubt whether the Peninsula plant (matched also by the Kinabalu specimens quoted below) is really this species, more especially as young plants from Malaya have quite broad pinnæ. I do not, however, know any other species to which our fern could be referred.

D. xiphophyllum, as here interpreted, is a fern of lowland and mid-mountain valleys, the highest altitude recorded in Malaya being 3,000 ft. It is fairly constant in character, differing from *D. riparium* in its much larger size and in other points mentioned under that species. There is one aberrant collection, that of Burkill from Ulu Chineras, which has long narrow pinnæ (to 3.8 cm. wide), long acuminate with edges more deeply toothed than normally, the vein-groups less branched and without anastomosis, and fewer sori in each group.

Specimens in the Singapore Herbarium:—

SIAM. Patani, 160–350 m., Eryl Smith 1922; Khao Rum, Eryl Smith 618.

PERAK. No loc., Herb. Mus. Perak 234; Jor Camp, Henderson F.M.S. Mus. 10833; Waterloo, Curtis 1361 p.p.; Larut, 3,000 ft., King's Collector 2698; Temango, Ridley 14227.

PAHANG. Ulu Chineras, K. Lipis, S.F.N. 15692 (Burkill).

SELANGOR. Ginting Peras, Ridley 7833; Ginting Simpah, 2,000 ft., S.F.N. 34310 (Md. Nur), 1,500 ft., Hume 8782, 8777, 8542; Kajang, Symington 24200 (F.D.).

BORNEO. Kinabalu, 5,000 ft., Clemens 29406; 3,500 ft., S.F.N. 25258 (Holtum).

LIST OF COLLECTORS' NUMBERS CITED

(The figures in brackets refer to the numbers given to the species in this paper)

<i>S.F.N.</i>	25444 (20)	10849 (13)
3829 (18)	31194 (9)	10959 (12)
7953 (20)	31295 (13)	<i>Hume (Herb.</i>
8844 (15)	31334 (5)	<i>F.M.S. Mus.)</i>
9770 (13)	32937 (13)	8551B (13)
9876 (2)	34310 (25)	7117 (17)
9982 (13)	35012 (19)	8186 (16)
10018 (2)	35995 (17)	8542 (25)
11007 (10)	36503 (15)	8777 (25)
11198 (19)	36504 (10)	8782 (25)
11473 (2)	36505 (2)	8997 (14)
11478 (15)	36507 (18)	9110 (18)
11515 (13)	36508 (20 var.)	9347 (14)
11563 (11)	37159 (2)	9665 (14)
14103 (13)	37201 (15)	9677 (14)
15323 (16)	<i>Ridley</i>	<i>Curtis</i>
15403 (5)	1587 (16)	1352 (8)
15457 (20 var.)	2167 (12)	1360 (17)
15692 (25)	2400 (13)	1361 p.p. (2)
17978 (2)	5818 (17)	1361 p.p. (25)
18301 (16)	7833 (25)	3369 (14)
18583 (12)	7843 (9)	10135 (13)
18612 (19)	7852 (9)	<i>Eryl Smith</i>
19302 (19)	8139 (12)	618 (25)
19342 (13)	8652 (9)	1198 (5)
19346 (2)	11271 (19)	1922 (25)
19498 (17)	13432 (19)	1927 (14)
19776 (13)	13975 (13)	1929 (17)
20554 (2)	14023 (19)	1930 (14)
20747 (20)	14206 (13)	1948 (12)
20792 (16)	14209 (12)	<i>Forest</i>
21636 (18)	14211 (18)	<i>Department</i>
21645 (15)	14227 (25)	14602 (13)
22089 (13)	14229 (2)	24200 (25)
22388 (18)	15991 (20)	<i>Herb. F.M.S.</i>
22422 (17)	<i>King's Collector</i>	<i>Mus.</i>
23262 (13)	(<i>Kunstler</i>)	10833 (25)
23340 (2)	2214 (18)	<i>Wray</i>
23361 (13)	2346 (18)	3590 (16)
23518 (13)	2391 (14)	3594 (17)
23620 (5)	2698 (25)	3616 (2)
24382 (17)	7146 (14)	3626 (17)
24558 (16)	7151 (19)	3862 (20 var.)
24703 (12)	7403 (20 var.)	<i>Haniff</i>
24704 (17)	7894 (16)	4047 (12)
24780 (16)	8420 (18)	<i>Alvins</i>
25258 (25)	8797 (9)	3282 (16)